tial at the entrance (for the first heat engines **754**, in this example) to the system and much smaller temperature differentials at the exit (for the third heat engines **756**, in this example).

[0171] Referring now to FIG. **12**, and with continued reference to FIGS. **1-11**B, there is shown an SMA member **822**, which may be used with large-scale heat engines. The SMA member **822** is a round, three-dimensional SMA working element. Features and components shown and described in other figures may be incorporated and used with those shown in FIG. **12**.

[0172] The SMA member **822** includes a plurality of SMA strands **823**, which may be SMA wires, strips, or another other cross section. The SMA strands **823** are braided into a large sheet around a cylindrical mandrel **827**. The dry SMA strands **823** may then be infiltrated with a matrix **826** (such as an elastomer) to provide adhesion and robustness.

[0173] The elastomer matrix **826** may be intrinsically thermally conducting or may be doped or filled with materials to enhance the conduction and heat transfer with the SMA strands **823**. These fillers may include, without limitation, metal or carbon/graphite wires, microwires, and nonwires, as well as other high-aspect-ratio fillers like platelets. The matrix **826** protects the SMA strands **823**, provides enhanced thermal transport into and out of the SMA strands **823**, and may provide increased friction on associated drive pulleys.

[0174] Depending on the configuration of the heat engine, the SMA member **822** can be maintained as a tube for direct implementation or can be slit and then rejoined for application to the heat engine. Furthermore, non-active fibers, such as aramid fibers, may be used as a core for the SMA member **822**.

[0175] Referring now to FIG. **13**, and with continued reference to FIGS. **1-12**, there is shown a portion of a large-scale heat engine **914**, which may be used with large-scale energy harvesting systems. Features and components shown and described in other figures may be incorporated and used with those shown in FIG. **13**.

[0176] The large-scale heat engine **914** includes a plurality of SMA members **922**, which may be, for example and without limitation, SMA belts, SMA braids, or SMA meshes. The plurality of SMA members **922** allow large scale conversion of thermal energy from heat sources and cold sinks (not shown) into mechanical energy in the form of movement of the plurality of SMA members **922**.

[0177] The mechanical energy from the plurality of SMA members **922** is transferred to a driven component (not shown) such as an electrical generator. The driven component in the large-scale heat engine **914** is in powerflow communication with a plurality of driven pulleys **938**.

[0178] The plurality of drive pulleys **938** are arranged such that the plurality of SMA members **922** may be stacked and layered relative to each other. The plurality of drive pulleys **938** then transfer mechanical energy to the driven component through a gear box or transmission arrangement, such that the combined power from the plurality of drive pulleys **938** and the plurality of SMA members **922** may be used to generate the output power from the large-scale heat engine **914**.

[0179] Referring now to FIG. **14**, and with continued reference to FIGS. **1-13**, there is shown a plan view of a heat engine **1014**, which may be used with small or large-scale energy harvesting systems. Features and components shown and described in other figures may be incorporated and used with those shown in FIG. **14**.

[0180] The heat engine **1014** shown in FIG. **14** has a single SMA working element **1022** that forms multiple loops around the heat engine **1014**. The SMA working element **1022** circumscribes a first pulley **1038**, a second pulley **1040**, and an idler pulley **1042**. Note that the opposing side of the SMA working element **1022** is not shown. In the configuration shown, the SMA working element **1022** forms approximately thirteen loops.

[0181] Even though the SMA working element **1022** loops numerous times, which improves the frictional contact with the first and second pulleys **1038**, **1040**, the SMA working element is welded only twice, at two joints **1027**. Weld points and other joining regions may represent weak spots within loop working elements. Therefore, as opposed to multiple loops that are each formed from individual working elements, the SMA working element **1022** yields the benefits of multiple loops (additional contact area with the pulleys, additional areas of phase change, etc.) but does not greatly increase the number of weak spots in the loops.

[0182] The detailed description and the drawings or figures are supportive and descriptive of the invention, but the scope of the invention is defined solely by the claims. While some of the best modes and other embodiments for carrying out the claimed invention have been described in detail, various alternative designs and embodiments exist for practicing the invention defined in the appended claims.

1. An energy harvesting system in thermal communication with a hot region and a cold region, comprising:
- a hot end heat engine in thermal communication with the hot region, including:
  - at least two rotatable pulleys;
  - a timing cable disposed about a portion of the at least two rotatable pulleys and defining a timing pulley ratio;
  - a hot end shape memory alloy (SMA) element disposed about the at least two rotatable pulleys and defining an SMA pulley ratio different than the timing pulley ratio, wherein the hot end SMA element has a hot side and a cold side; and
  - wherein the hot side of the hot end SMA element is directly in thermal communication with the hot region;
- a cold end heat engine in thermal communication with the cold region, including:
  - at least two rotatable pulleys;
  - a timing cable disposed about a portion of the at least two rotatable pulleys and defining a timing pulley ratio;
  - a cold end SMA element disposed about the at least two rotatable pulleys and defining an SMA pulley ratio different than the timing pulley ratio, wherein the cold end SMA element has a hot side and a cold side; and
  - wherein the cold side of the cold end SMA element is directly in thermal communication with the cold region;
- an intermediate heat engine, including:
  - at least two rotatable pulleys;
  - a timing cable disposed about a portion of the at least two rotatable pulleys and defining a timing pulley ratio;
  - an intermediate SMA element disposed about the at least two rotatable pulleys and defining an SMA pulley ratio different than the timing pulley ratio, wherein the intermediate SMA element has a hot side and a cold side; and
  - wherein the hot side of the intermediate SMA element is in thermal communication with the cold side of the